

VAUCHERIA SUBSIMPLEX CROUAN FROM A
MASSACHUSETTS SALT MARSH:
FIRST UNITED STATES RECORD

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ABSTRACT

Vaucheria subsimplex Crouan has been collected from a salt marsh at Gloucester, Massachusetts. This report appears to be the first citation of this species in the United States, and it is the second in North America. At Gloucester, *Vaucheria subsimplex* and *V. velutina* occur as a "zone" at MHW in the mud of tidal creek banks, these algae forming gametangia throughout the summer. Ecological observations of the Gloucester material compare favorably with similar data about *V. subsimplex* from European and Scandinavian salt marshes.

Key Words: *Vaucheria*, salt marsh, Massachusetts

INTRODUCTION

Prior to 1960, the only paper dealing with the botany of Massachusetts salt marshes was that of Chapman (1940), which emphasized the biology of seed plants at a marsh in the town of Saugus. Indeed, field studies of marine algae at that time had not dealt specifically with the salt marsh habitat, but centered about the vegetation of open coasts in temperate regions of the world. Such paucity of algal research in salt marshes prompted field and laboratory studies emphasizing benthic algae in an extensive salt marsh-estuary complex at Ipswich, MA (e.g., Wilce et al., 1970; Webber and Wilce, 1971).

Vaucheria species are among the most conspicuous algae in New England salt marshes. Their massed threads commonly form green to greenish-black "turfs" on mud and marine peat substrata. Despite their prevalence, only 4 species of *Vaucheria* were known from New England salt marshes before 1953. At this time, reports by Blum and Conover (1953), and later by Blum (1960) and Webber (1968), resulted in 10 *Vaucheria* taxa recognized from Massachusetts salt marshes. The taxa are: *V. compacta* (Collins) Collins; *V. litorea* C. Ag; *V. piloboloides* Thur.; *V. velutina* C. Ag.; *V. arcassonensis* Dangeard; *V. coronata* Nord.; *V. intermedia* Nord.; *V. minuta* Blum and Conover; *V. vipera* Blum; *V. compacta* (Collins) Collins var. *koksoakensis* Blum and Wilce. An additional species, *V. nasuta* Taylor and Bernatowicz, was collected from a salt marsh in Gloucester (Webber, 1976). I have

since found *V. nasuta* in abundance at a Yarmouthport salt marsh (Cape Cod), and recently it was located for the first time in Connecticut (Schneider et al., p. 108).

MATERIALS AND METHODS

During August, 1987, collections of *Vaucheria* were made in the Cape Ann region of Massachusetts. The type locality for *V. vipera* in Essex, and a small salt marsh immediately behind Gloucester Harbor were chosen as collecting sites. At Essex, samples were taken from the mud banks of a tidal creek, as well as from a poorly drained section of the marsh populated by *Salicornia europaea* L. From the marsh at Gloucester, *Vaucheria* was evident both on creek banks and on the muddy soil beneath *Spartina alterniflora* Loisel.

Collections were returned to Keuka College, Keuka Park, NY, and kept in petri plates under ambient day/night periods for several additional days until green "tufts" arising from the mud were apparent. At this time, small portions of this new growth were placed in sterile petri dishes containing Erd-Schreiber medium (Provasoli et al., 1957). The algae were then grown in a culture chamber at 16°C under constant light, the dishes being approximately 10 cm below a 20 W cool fluorescent light. Fresh medium was added at weekly intervals, and all cultures were examined microscopically at this time.

RESULTS AND DISCUSSION

Nine days after inoculation, antheridia and oogonia formed on the *Vaucheria* from the Essex creek banks, and two species, *V. vipera* and *V. velutina*, were identifiable.

Collections of mixed *Vaucheria* species are common. Because of this mixing, it is important to maintain cultures until all the algae have reached a sexual reproductive condition, i.e., until all species from the mix are identified.

For example, in a Gloucester site collection, two weeks after initial inoculation, *V. litorea* was abundantly reproductive. The algae were removed, preserved in a 3% formalin-sea water mixture, and the vegetative material was left in the petri dish. On September 15, 1987, 45 days after initial inoculation, these *Vaucheria* threads became reproductive. Upon microscopic ex-

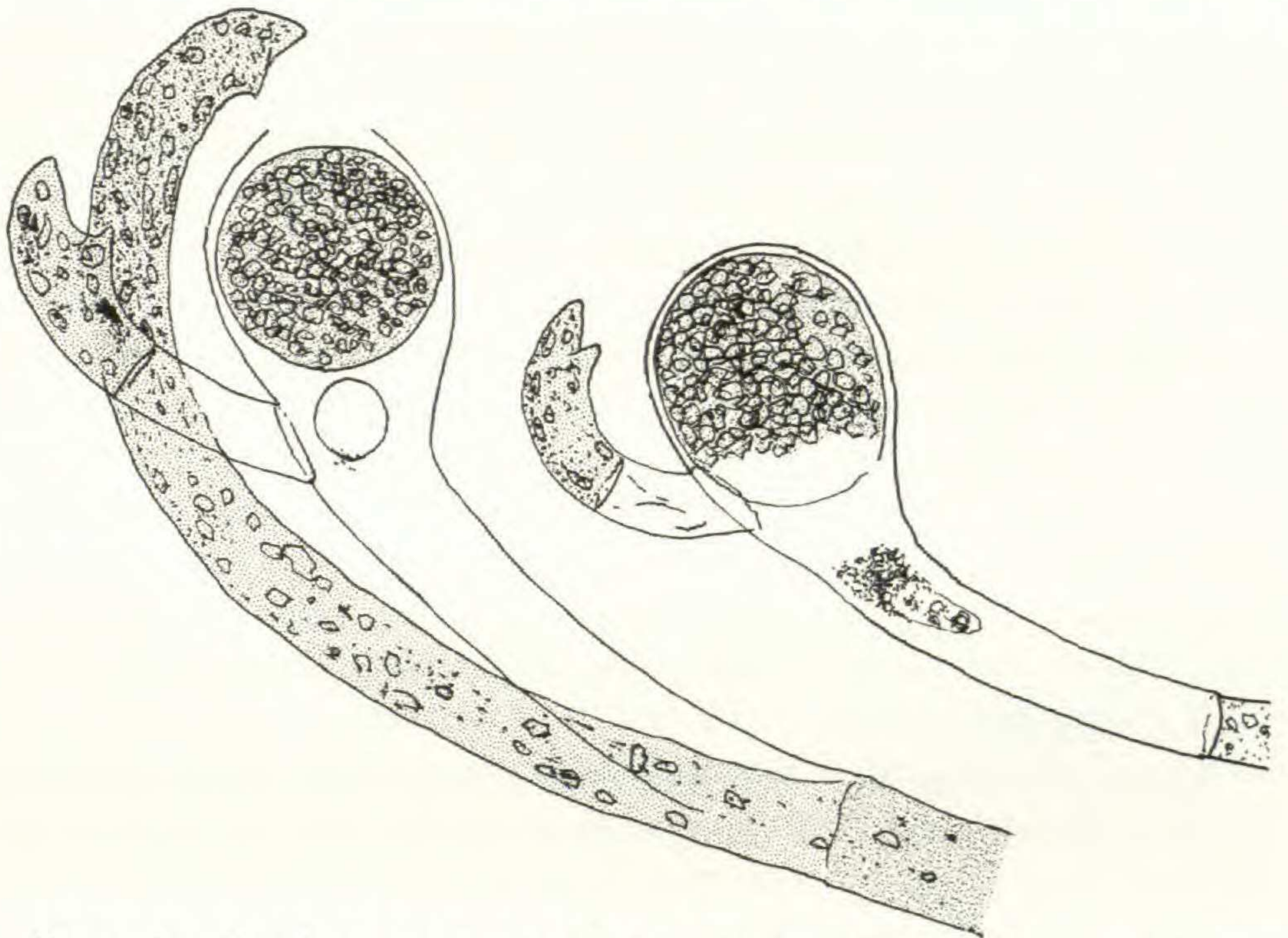


Figure 1. *Vaucheria subsimplex* Crouan showing the typical terminal gametangia with the antheridia characteristically in an arc toward the oogonia. Material collected from a salt marsh, Gloucester, MA, in summer, 1987. Drawing by Dr. John Blum. Magnification 150 \times .

amination, the algae were identifiable as *Vaucheria subsimplex* Crouan. At this time, other cultures from the same field location also contained *V. subsimplex* (Figure 1).

Vaucheria subsimplex is of common occurrence in European salt marshes. The Gloucester, MA record appears to be the first record of this species in the United States, and it is the second in North America. The first report of *V. subsimplex* in North America was based on material from Ungava Bay, Quebec (Blum and Wilce, 1958).

The Gloucester and Essex, MA locations were re-visited in early June, 1992, and additional *Vaucheria* collections were taken. Culture conditions for these collections were the same as described in METHODS. On June 18, *V. subsimplex* was located in one collection from the Gloucester tidal creek banks. Mixed with this species was *V. velutina*, which also appeared in other collections from this site. Thus, a *V. subsimplex/V. velutina* "zone" exists on the Gloucester mud creek banks at MHW level. Small amounts of *V. nasuta* also appeared in these and additional collections from this "zone."

The prevalence of a summer reproductive *Vaucheria subsimplex*/*V. velutina* mixture on tidal creek banks at MHW has been reported from the Netherlands (e.g., Nienhuis and Simons, 1971; Polderman, 1975b). In another study, Polderman (1975a) cited the winter and autumn as prime reproductive times for *V. subsimplex*. Also, according to Simons and Vroman (1973), *Vaucheria subsimplex* and *V. velutina* are "summer species" growing mostly on the seaward edges of shores on hydrogen sulfide containing substrata where soil moisture and salinity are high. These same authors (1968) stated that *V. subsimplex* may also reproduce sexually to a lesser degree in winter and spring. Winter data from Gloucester concerning the reproduction of this species is not available, but *V. subsimplex* readily forms gametangia during the summer in Massachusetts.

Salinity levels at the Gloucester site appear high. Salinities from a site approximately 100 meters seaward from the above location show a range from 22‰ to 29‰, with extremes of 17‰ and 31‰ (Mass. Audubon Soc., 1990). In laboratory experiments (Christensen, 1988) *Vaucheria subsimplex* showed maximum growth at 22‰, and gametangia were formed between 10 to 30‰, thus supporting his field observations that *V. subsimplex* occurs in sites of "constant and high salinity."

In addition to being a component of the *Vaucheria subsimplex* "zone" at Gloucester, *V. velutina* is common also at Essex and deserves further mention. Here, it is mixed with *V. vipera* and *V. compacta* and inhabits exposed sites of wet black muck in the upper littoral, subject to sea water dilution by rainfall and flooding by spring tides. Such observations suggest a euryhaline nature for *V. velutina*, which is confirmed by culture studies and its occurrence with *V. compacta* "high up in estuaries" (Christensen, 1988). Further, *V. velutina* appears to increase its vegetative mass under field conditions through abundant aplanospore production and germination (Knutzen, 1973; Simons and Vroman, 1973; Simons, 1975). Asexual reproduction by aplanospores was common in several of my *V. velutina* cultures.

CONCLUSIONS

The first United States record for *Vaucheria subsimplex* Crouan is reported from a salt marsh at Gloucester, MA. *Vaucheria subsimplex* and *V. velutina*, admixed with small quantities of *V.*

nasuta, form a "zone" at MHW on tidal creek banks. Such an occurrence appears related to high moisture and salinity levels of their mud substrata. *Vaucheria subsimplex* readily forms gametangia throughout the summer; winter data concerning the reproduction of this species is not yet available. Ecological observations of *V. subsimplex* at Gloucester compare favorably with relevant data about this species from various salt marshes in Europe and Scandinavia.

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